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ORIGINAL ARTICLE

Prevalence of simple and complex sacral perineural Tarlov cysts in a French cohort of adults and children

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Summary
Objective: To determine the prevalence of simple and complex sacral perineural Tarlov cysts (TCs) in a cohort of children and adults.
Material and methods: Retrospective observational epidemiological study assessing 1100 consecutive sacral magnetic resonance (MR) studies, including 100 children and adolescents. All patients underwent 1.5 T MR imaging with T1 and T2 weighted image acquisitions in sagittal and axial planes. All perineural cysts affecting the sacral nerve roots S1—S4 were quantitatively and qualitatively assessed.
Results: Two hundred and sixty-three sacral TCs were found in 132 adult patients (13.2%), with a female predominance (68%). None was found in children. The prevalence of TCs increased with age. The average number of cysts per patient was 2.0 ± 1.2 with a maximum of 6 cysts in a single patient. Most of the cysts (87.5%) showed a homogenous central fluid collection and a parietal course of the nerve fibers. Complex patterns were present in 33 cysts (12.5%) within which 28 cysts showed endocystic crossing of nerve fibers and 5 cysts contained internal septations. Seventy cysts (26.6%) eroded the adjacent bone and 13 cysts (4.9%) extended to the pelvis.

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Conclusion: The prevalence of sacral TCs in our cohort corresponded to 13%, with a female predominance. Interestingly no TCs were found in children or adolescents (< 18 years). In relation to the non-negligible percentage of complex cysts with internal septations, or endocystic crossing of nerve fibers, pre-interventional characterization of sacral TCs might help to choose an appropriate procedure in the treatment of rare symptomatic variants.

Introduction

Perineural Tarlov cysts (TCs) [1], classified by Nabors et al. [2] as extradural meningeal cysts with inclusion of spinal nerve-root fibers, are found around the dorsal nerve root ganglion and between the endoneurium and perineurium [3]. They commonly affect the sacral nerve roots and they characteristically contain nerve fibers in their walls or cavities [4]. Occasionally, they may cause distortion of local nerves and erosions of adjacent bone [3,4]. Lined with arachnoid cells and vascularized connective tissue, TCs may show delayed filling during spinal myelography in relation to a potential valve effect [1]. Nerve root sleeve dilatations might represent a precursor of TCs [1,2,4]. However, due to free circulation of cerebrospinal fluid, as seen on myelography, compressive effects on nerve roots are not expected at this stage [1].

Most studies found a prevalence of TCs of 1—5% in adult subjects [5—7]. However, a recent analysis of 422 sacral MR images from an eastern Europe cohort elicited a much higher prevalence of 15% with a female predominance [8].

Usually TCs are asymptomatic incidental findings, but symptomatic variants have been reported [6,7,9,10]. These symptoms consisted mainly of perineal and low back pain, sphincter incontinence and sexual disorders [9,11,12]. Sparse data on electro-physiological consequences is available, with one study finding sensory nerve action potential (SNAP) abnormalities in certain subjects, without any alterations in motor nerve conduction [13]. Regarding the treatment of symptomatic TCs, various (micro-) surgical techniques have been described [14,15]. In addition, different studies assessed the safety and efficacy of image-guided percutaneous injection of fibrin sealant and elicited promising outcomes [16—19].

Different types of TCs have been described, however, without analyzing their respective prevalence in a larger patient collective. This information might be helpful in pre-interventional assessments of potentially symptomatic TCs in order to find the most adequate treatment. Thus, the aim of the present study was to examine the prevalence of sacral TCs as found in current MR imaging in a university hospital setting and to determine the proportion of simple and complex variants in a cohort of adults and children.

Material and methods

This observational epidemiological study has been carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki). One thousand one hundred ($n = 1100$) consecutive magnetic resonance (MR) studies covering the sacrum (i.e. spinal roots S1—S4) were retrospectively assessed. Considered for inclusion were MR studies of the lumbar spine or the pelvis with T1 and water-sensitive MR images for variable indications. Demographical characteristics consisted of 604 adult women and 396 adult men (mean age $\pm$ standard deviation (SD), 52 ± 17.5 years; range, 18—94 years) and 100 children or adolescents with less than 18 years of age (mean age $\pm$ SD, 12 ± 4.2 years; range, 2 month—17 years). The ethnicities should reflect the society of Paris/France with a majority of Caucasian background, but also with a noticeable percentage of people with African, Middle Eastern and Asian origin. The study design was similar to previous studies evaluating the prevalence of TCs [7,8].

Image acquisition

All patients underwent 1.5 Tesla MR imaging (MAGNETOM Avanto, Siemens Healthcare, Erlangen, Germany; SIGNA, GE Healthcare, Waukesha, WI, USA) in the supine position. T1 weighted imaging was based on spin echo or gradient echo sequences in the sagittal plane with a slice thickness of 1.3—4 mm. T2 weighted (T2w) images were acquired with either spin echo or short tau inversion recovery (STIR) sequences in the sagittal plane (slice thickness 4 mm), or with 3D turbo spin echo SPACE (Sampling Perfection with Application optimized Contrasts using flip angle evolution) sequences in the axial plane (slice thickness 1—1.3 mm) and subsequent multi-planar reformatting.

Image analysis

Data was stored in the hospital's picture archiving and communication system (PACS) and analyzed using the Carestream Vue software (Carestream Health Inc., Rochester, NY, USA). All images were visually scanned for perineural TCs (Nabors classification II) $\geq$ 5 mm. Diagnostic criteria consisted of circular and sharply delineated structures with an iso-intense signal to cerebrospinal fluid (CSF) on T2w images, centered on the posterior nerve root ganglion, and integrating parietal or endocystic nerve fibers. All accordant lesions of the sacral nerve roots S1—S4 were quantitatively and qualitatively assessed. Quantitative analysis included the maximal axial diameter of cysts and the number of cysts per patient. Qualitatively evaluated were topography (S1-S4), shape (round/oval or tubulated/lobulated), intracystic architecture, bone erosions, and potential pelvic extensions. Nerve root sleeve dilatation, dural ectasias, meningeal diverticula and subarachnoid cysts were not included in the assessment.